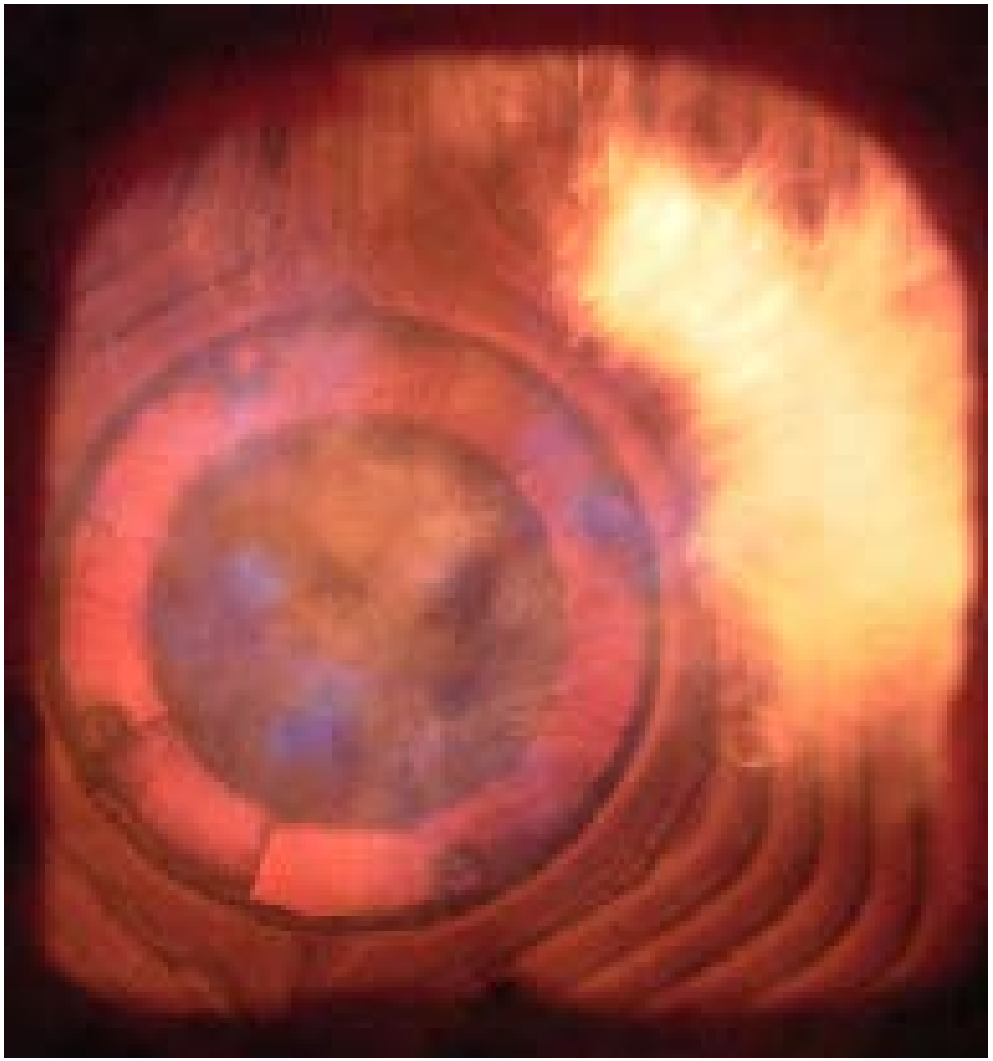


Energy Efficiency & Combustion Controls by John Devine

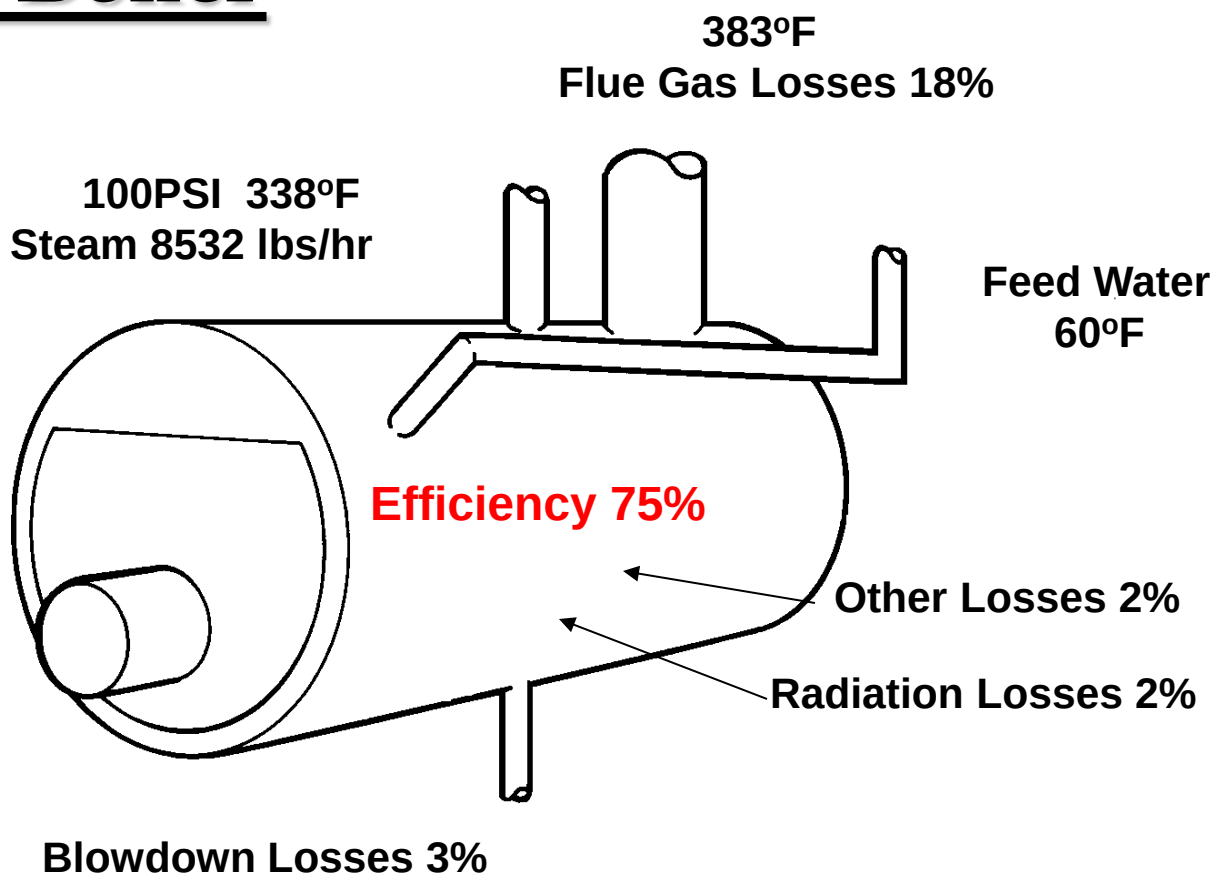
Energy Savings

"Minimum running costs are achieved by running boilers at high thermal efficiency"

Energy Savings

- Boiler efficiency can be increased by 1% for each 15% reduction in excess air or 40^{o} F reduction in stack gas temperature.

Typical Boiler

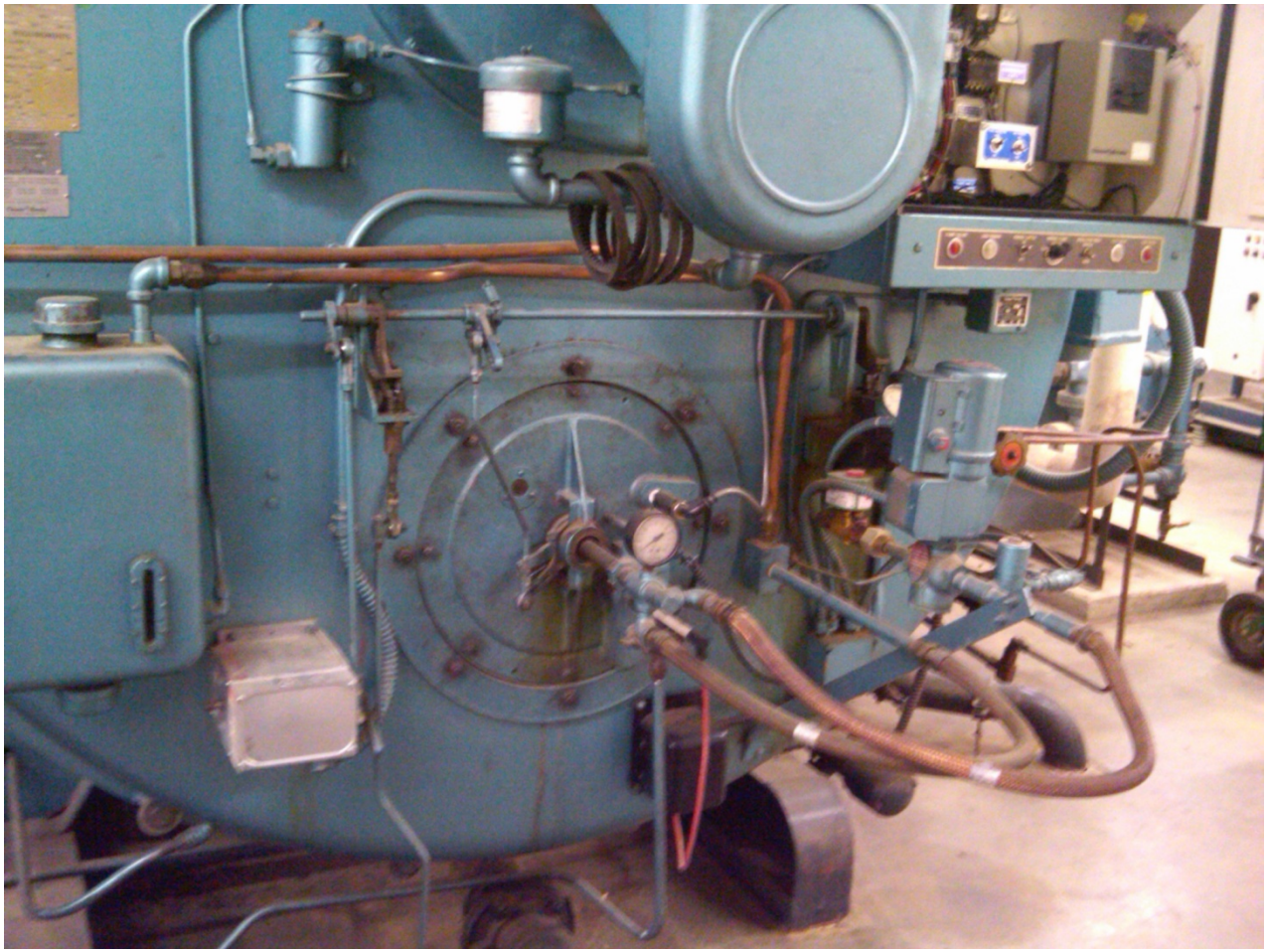


Typical Losses

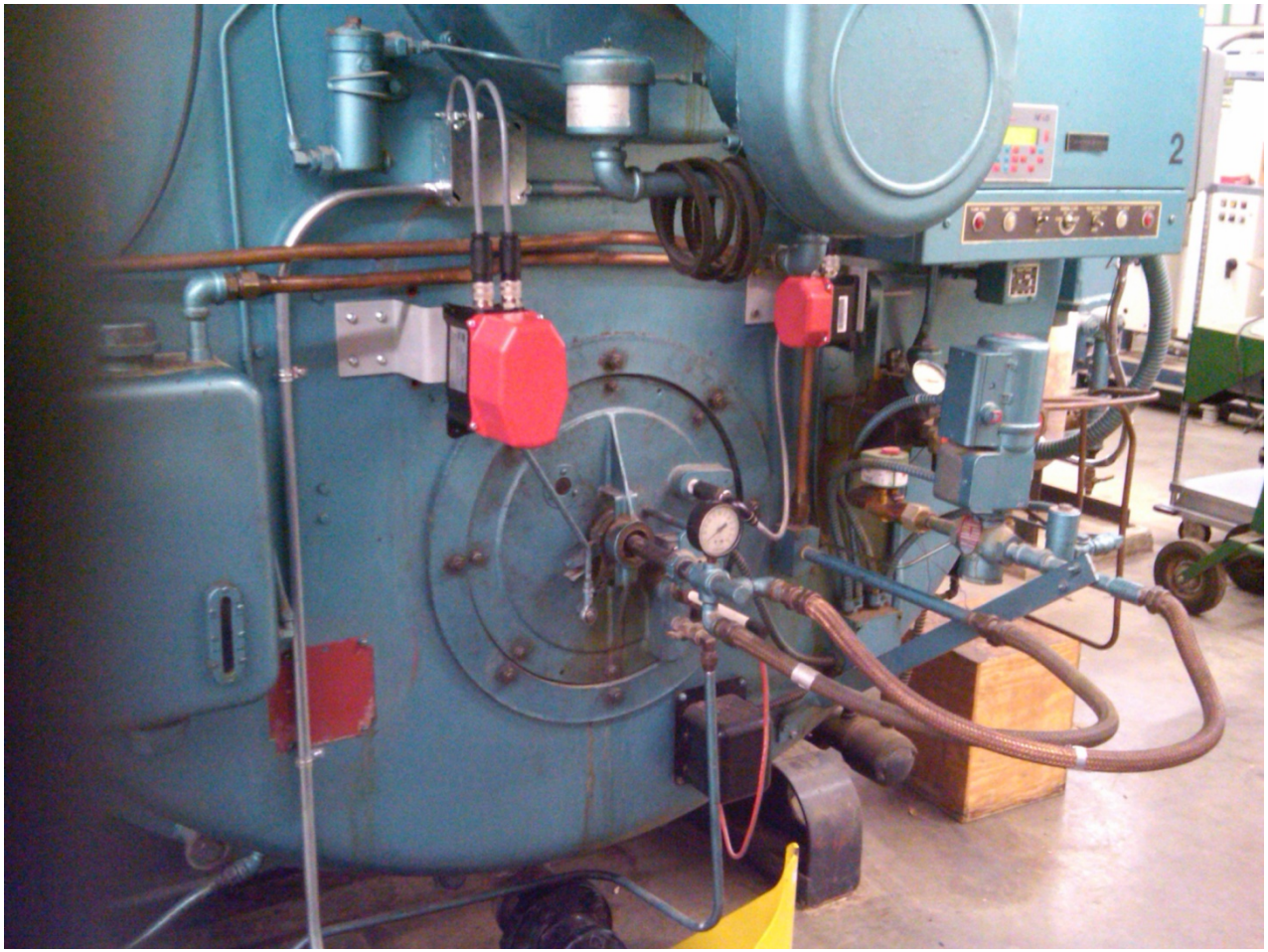
The Golden Numbers

- Parallel Positioning - open loop – 3-5%
- O2 Trim closed loop - 1 - 2%
- Variable Speed Drive - 40% electrical, 0.5% turndown
- Lead Lag Sequencing - 1 - 3%

Single Point Positioning



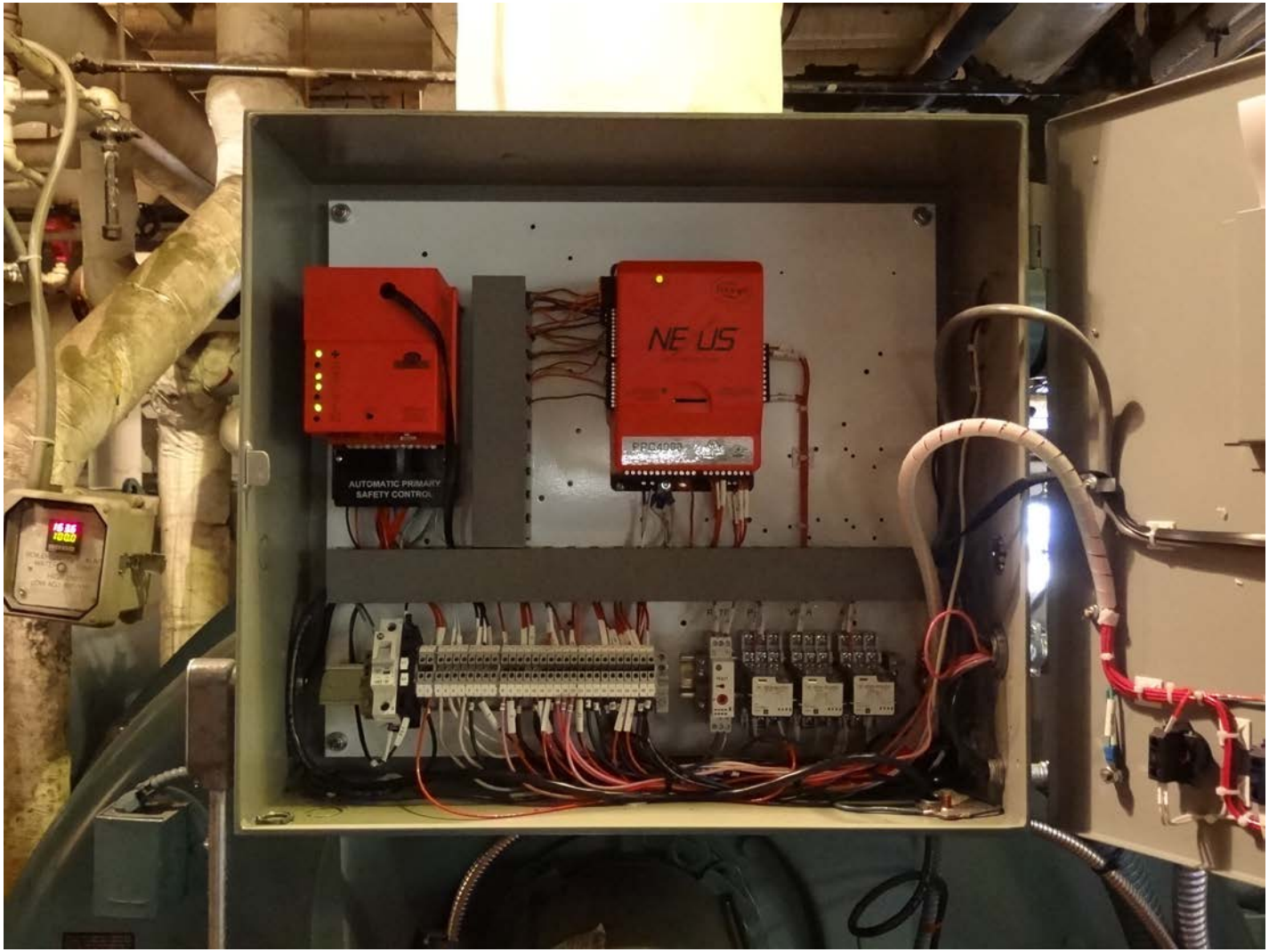
Parallel Positioning



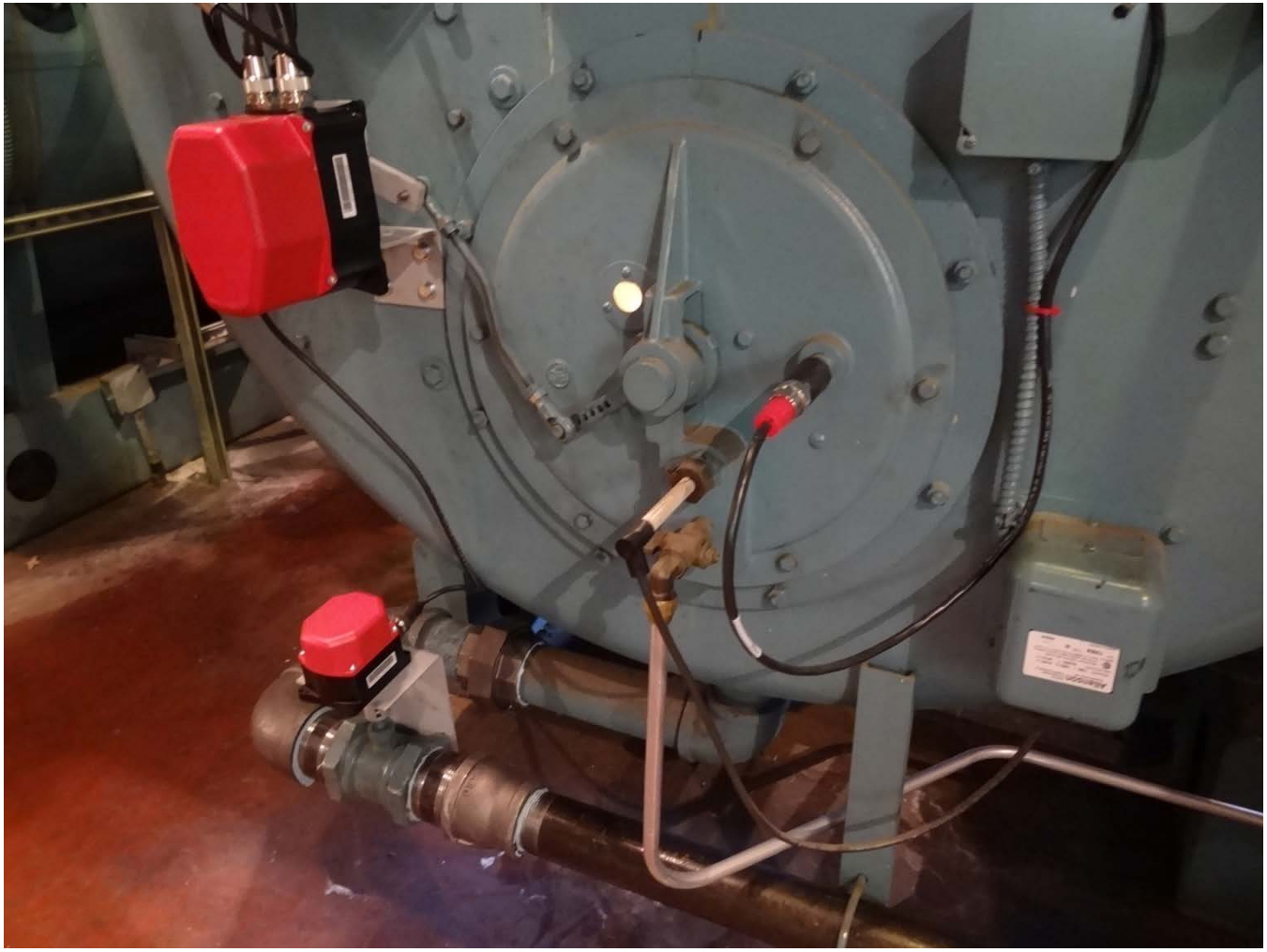
Two CB Hot Water Boilers



New Panel Insert



Air & Fuel Servos



VFD



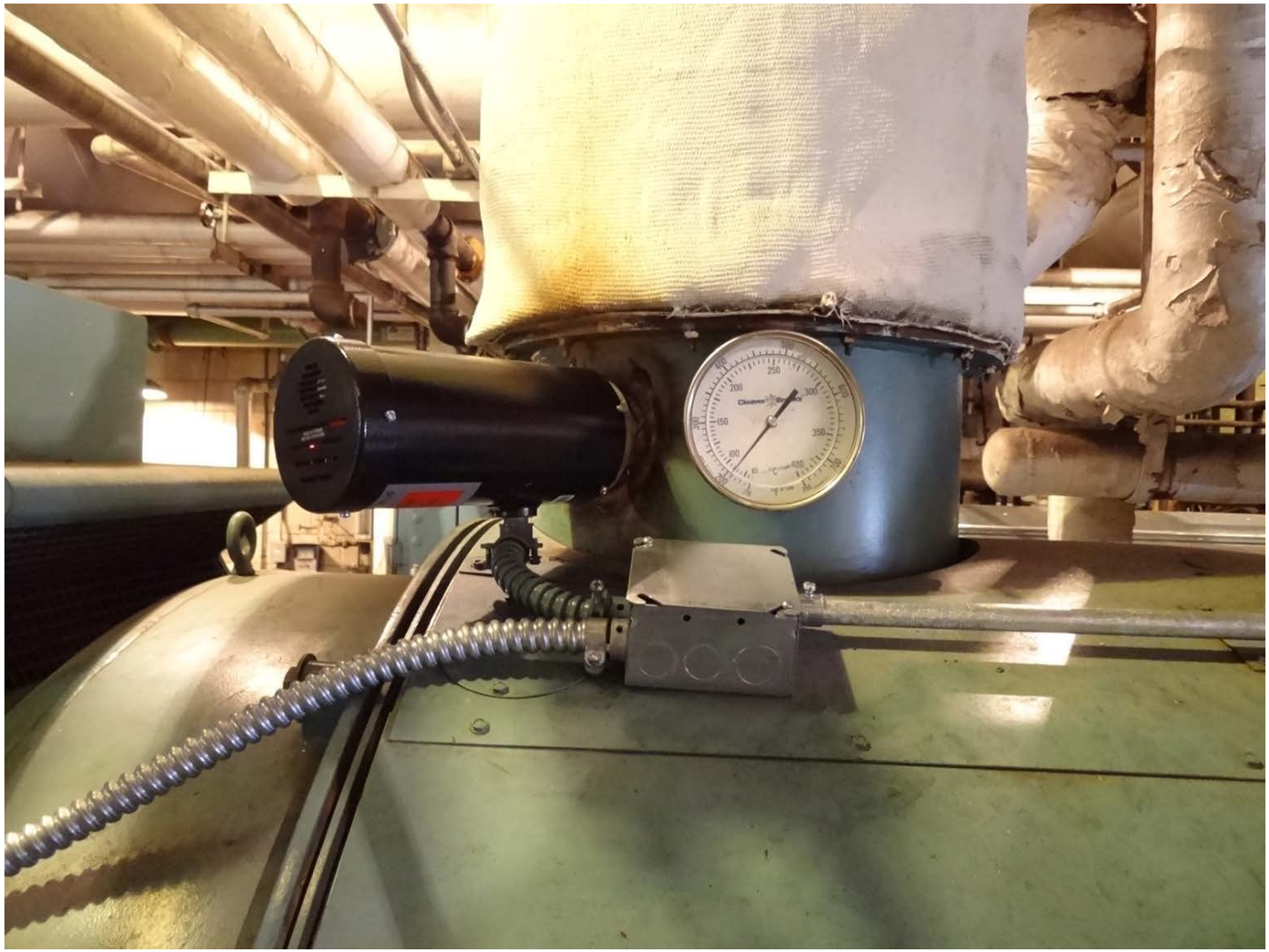
Savings Broken Down

- **Increased Turndown: 1.0%**

(The independent light off position and use of VFD both provide a real opportunity to increase the possible turndown on the boiler).

(Increasing turndown has a marked impact on boiler cycling).

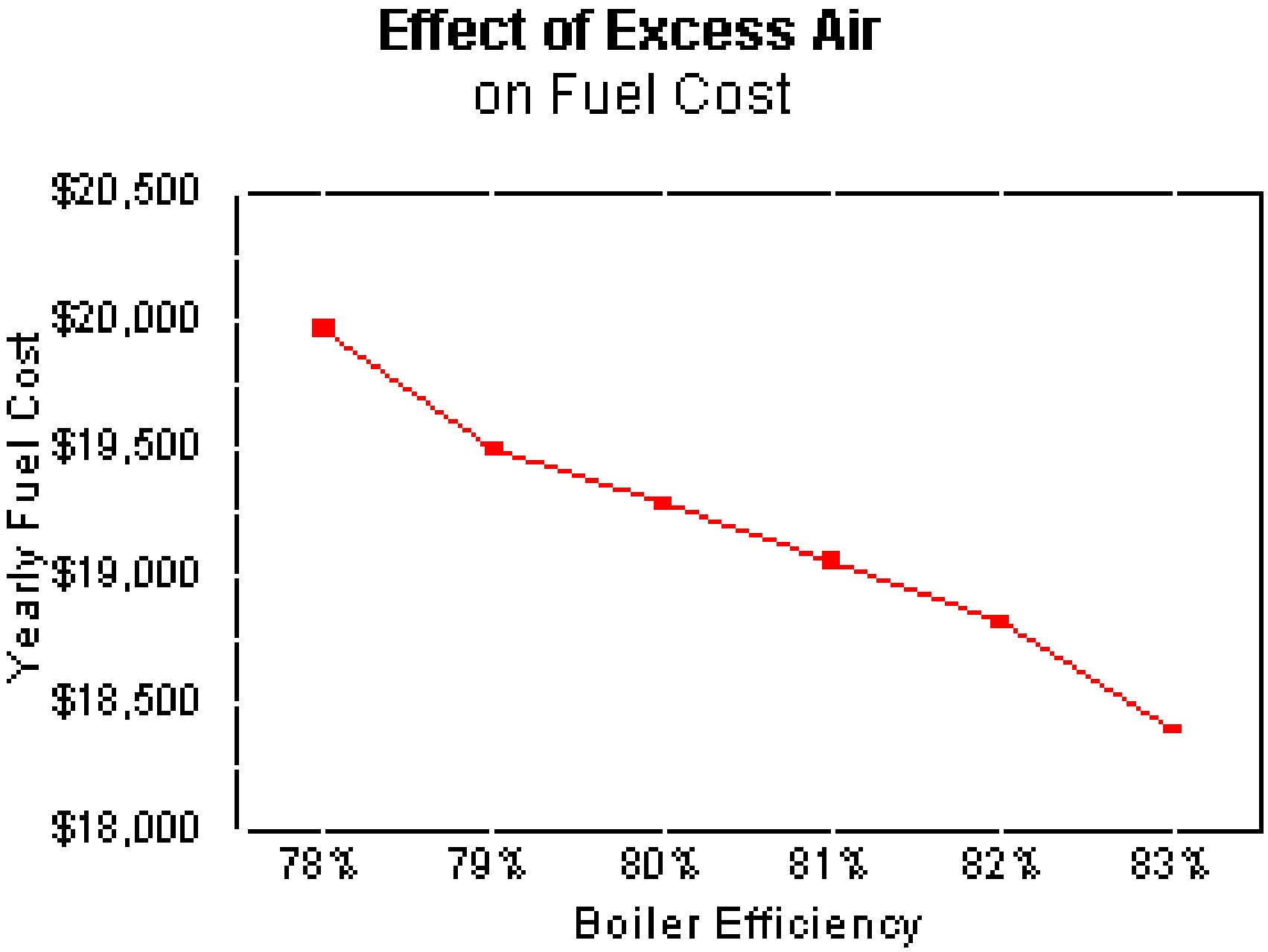
O2 Probe



Savings Broken Down

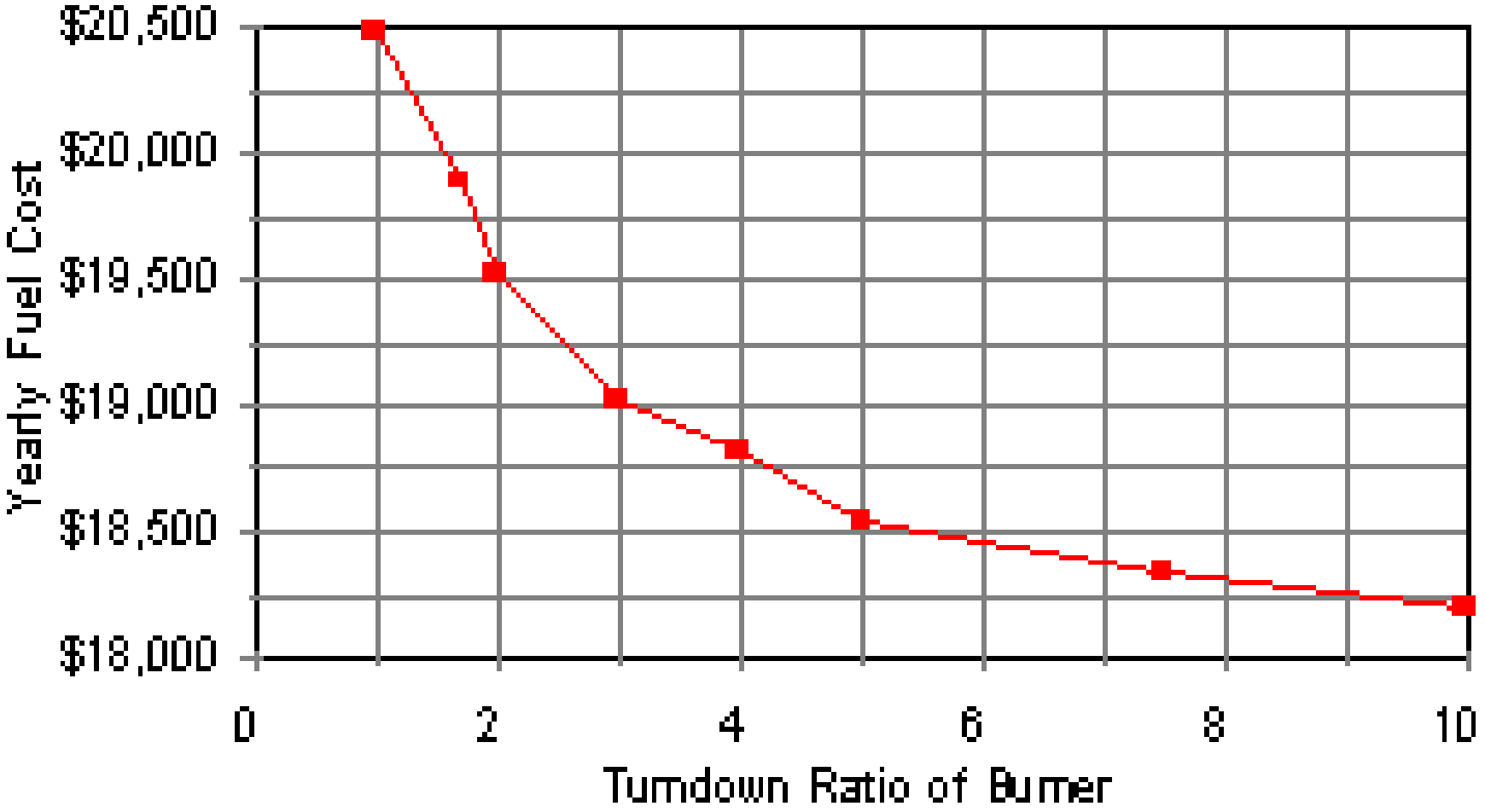
- O2 Trim: 1 -2 %

(Compensates for changes in temperature, barometric conditions, air density, fuel pressure etc that can affect combustion repeatability)



* WEISHAUPT Germany

Effect of Turndown on Fuel Cost



* WEISHAUPT Germany

Two 600 HP Low Pressure Steam Boilers



Four Dual Fuel Burners



Boston School's Natural Gas, VFD, O2 Trim

